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the direct excitation of each stimulus, y the counter-excitation set up thereby, k the increment of y , n any number of additional terms, and c the response. No good reason appears for assuming a counter-reaction. Partial or complete recovery from the primary excitation in the intervals of stimulation is a simpler assumption and would seem equally to account for the facts. Further details must be sought in the paper itself.—C. R. B.

Edaphic steppes in Sweden.—The “alfvar” is a name given in Sweden to some remarkable formations that occur chiefly on the island of Öland, and to a lesser degree on the island of Götland, and in the mainland province of Västergötland. The name “alfvar” is applied to extensive treeless plains, whose underlying rock is a Silurian limestone. While there are several plant formations, the alfvar presents general ecological unity, and it has an extremely xerophytic stamp. It is somewhat similar to the “garigue” of southern Europe, and to certain rock formations of Servia. The physiognomy is that of a steppe, and yet there is anything but a steppe climate in Sweden. There is no question that the alfvar is determined by edaphic causes in the main (such as the dryness and temperature changes of the rocks, which are everywhere at or near the surface, and the poverty of the scanty soil), reinforced by strong insolation and constant winds. The alfvar is very distinct in every way from the heath. Such a region is relatively rich in species, of which more than half are glacial or subglacial, and about a third are representatives of the oak flora. Six per cent. belong to the climatic steppe, and only 2 per cent. to the beech forest flora. This flora is doubtless a relict of a much more widespread flora in the period succeeding glaciation. There are two general aspects, the dominant aspect of the steppe, and the lesser aspect of the meadow. The herbaceous plants commonly dominate, although shrubs are frequently conspicuous. The leading character plants of the steppe are *Mollia tortuosa*, *Helianthemum oelandicum*, and *Cynanchum vincetoxicum*. The chief shrubs are *Juniperus communis* and *Potentilla fruticosa*. In less xerophytic places, *Festuca ovina* assumes a prominent place. There are often vast areas of *Cynanchum* almost alone, giving almost an exact picture of certain climatic steppes. Perhaps the most interesting part of the paper is the discussion of nanism. The author distinguishes facultative dwarfs, due to environmental causes, and constitutional dwarfs. Constitutional dwarfs (the group to which the term nanism more properly applies) differ from facultative dwarfs not only in breeding true, regardless of conditions, but also in a much greater qualitative reduction. Constitutional dwarfs show reduction in all organs, not chiefly in aerial vegetative organs; roots and rhizomes are reduced, while they are rarely reduced and often actually increased in facultative dwarfs. Constitutional dwarfs also show reduced floral organs, their internodes are fewer as well as shorter, and their leaves are reduced in number as well as in size. Most of the dwarfs are annuals, although some show a certain lability as to their duration. Species commonly perennial or biennial, for example, may become annual in very dry situations. The usual “protective” structures of xerophytic vegetation occur

here in high degree, and are regarded by WITTE¹⁰ as of advantage in checking transpiration. The alfvar was very fully treated from this standpoint some years ago by GREVILLIUS. Some plants commonly herbs here become half-shrubs, e. g., *Gypsophila fastigiata*. There is an excellent study made of the underground organs, which are frequently neglected.—H. C. COWLES.

Lateral roots.—NORDHAUSEN has studied the direction and growth of lateral roots under the influence of external factors, particularly those which arise from the removal of portions of the main root or its wounding.¹¹ It is well known that when a millimeter or less of the primary root is cut off, regeneration of the tip occurs; but when larger portions are removed, one or more of the lateral roots change their angle with the main axis, as it were to substitute themselves for it. NORDHAUSEN can only say, as one result of his studies, that this reaction on the part of the lateral roots is "dependent upon the intensity and quality of internal conditions which bear more or less relation to the needs of the plant," which of course is an empty form of words. It was already known that decapitation within the growth zone results in a very active substitution response. If the cutting exceeds this, however, whether much or little, says NORDHAUSEN, this response is minimal or wanting, provided a rather long piece of the primary root remains; but shortening the stump beyond a certain amount again increases the response. The alteration of the angle of the substitute roots with the main axis rests, contrary to the conclusions of BRUCK and CZAPEK, upon both geotropic and autotropic factors, of which the former is determinative. This substitution of lateral roots is independent of actual wounding, since it can be brought about by merely checking the growth, especially of the main axis. A partial response follows, even without disturbance or operation on the growing point, if certain tracts within the central cylinder (not only in the phloem but especially in the xylem) are interrupted by lateral wounding. The disturbance of nutrition here plays only a subordinate rôle. NORDHAUSEN agrees with MCCALLUM in assuming the existence of specific inhibitory stimuli, regulating the formation of organs in intact plants. Certain roots (*Lupinus*, *Phaseolus*) respond to a temporary past reduction in the water supply by altering the angle of lateral roots, which at the time of the difficulty had not even appeared, though when they develop they are under normal conditions. Lateral wounding of the main root leading to direct or indirect affection of the pericambium, even before the lateral roots become visible, produces a traumatropic deviation of these from the wounded side. The transmission of the excitation, easier in the acropetal than the basipetal direction, may produce sympathetic response of more distant lateral roots.

The influence of curvature of the main root upon the form and lateral deviation of the side roots, determined by NOLL and explained (?) as morphaesthesia, is due, according to NORDHAUSEN, to changes in the tension of the central cylinder,

¹⁰ WITTE, H., Till de Svenska alfvarväxternas ekologi. pp. 119. Upsala. 1906.

¹¹ NORDHAUSEN, M., Ueber Richtung und Wachstum der Seitenwurzeln unter dem Einfluss äusserer und innerer Faktoren. Jahrb. Wiss. Bot. 44:557-634. 1907.